

What is claimed is

1. A method for routing message flows on a network, which is composed of nodes and links, and each given node performs the method, which comprises:

delivering input information for each class of messages to the target nodes;

5 computing potential values for each class of messages, wherein the differences of the potential values for messages of a class to those of neighbor nodes of the given node represent the direction and the quantity of message flow of each class that are sent on neighbor links of the given node; and

 computing a routing table based on the differences of the potential values to
10 those of the neighbor nodes.

2. The method of claim 1, further comprises a step of assigning pre-determined weights on links according to performance parameters of interest.

15 3. The method of claim 1, wherein the step of delivering input rates for each class of messages to each target node is triggered periodically or on an event-driven basis.

 4. The method of claim 1, wherein the input information of messages for each
20 class of messages to each target node is delivered by means of broadcast or multicast algorithms via a control frame containing: a source node address, a target node address, a message class, and an estimated exogenous input rates of messages of the class.

25 5. The method of claim 1, wherein the step of computing potential values further includes the following steps:

initializing the potential values based on input information at the given node and received from other nodes;

iteratively receiving the potential values from the neighbor nodes of the given node; and

5 iteratively refining potential values of the given node, wherein an offset value based on the potential values received from the neighbor nodes is determined and the weights on the neighbor links are combined with the potential values.

6. The method of claim 1, wherein the potential value for a class of messages is
10 delivered between two neighbor nodes through a control frame containing a source node address where the potential value is generated, the target node address where the message is targeted, the class of the messages, and the potential value.

7. The method of claim 1, wherein the step of computing a routing table further
15 includes the following steps:

computing the difference of the potential value to those of the neighbor nodes for each class of messages and each target node, wherein the potential differences are the weighted potential values of the given node minus the weighted potential values of the neighbor nodes;

20 designating the neighbor node as one of downstream neighbor nodes for each class of messages to each target node, where messages of the class and with the target node are routed next, if the potential difference is larger than zero; and

creating the routing table based on the weighted potential values for each class of messages and each target node.

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8. A system for routing message flows on a network in order to keep the network operating in a nominal steady state, the system comprising:

means for a node to route message flows according to routing tables created based on the differences of the weighted potential values to those of the neighbor node;

means for generating and evaluating queuing information of the network
5 nodes;

means for delivering the queuing information between a pair of two neighbor nodes; and

means for a node to adjust its routing table in response to the queuing information to accommodate variation of traffic inputs and variation of network
10 topology.

9. The system of claim 8, wherein the queuing information for each class of messaged for each target node is communicated between a pair of neighbor nodes through a control frame containing a source node address, a target node address, a
15 message class, and queuing information.

10. The system of claim 8, wherein the queuing information is related to queuing length and expected queue length of the network nominal steady state.

20 11. The system of claim 10, wherein the means for a node to adjust the routing table adopts the following algorithm:

determining a queue-length ratio of an estimated queuing length over the expected queue length of the network nominal steady state for each message class and each target node at that node;

25 computing an adjusted flow rate between that node to a neighbor node to be the queue-length ratio of that node weighted by a performance parameter minus the queue-length ratio of the neighbor node also weighted by a performance parameter;

designating the neighbor node to be a downstream neighbor node for a class of messages to a target node, where messages of the class and to the target node are routed next, if the adjusted flow rate after adjustment is larger than zero; and
adjusting the routing table with the adjusted flow rates.